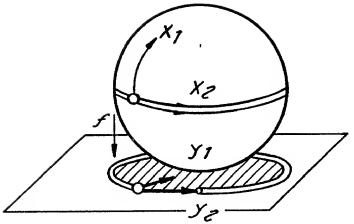


FIG. 1A

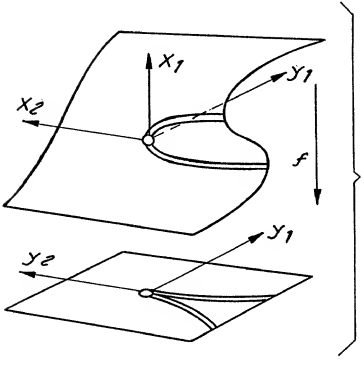


FIG. 1B

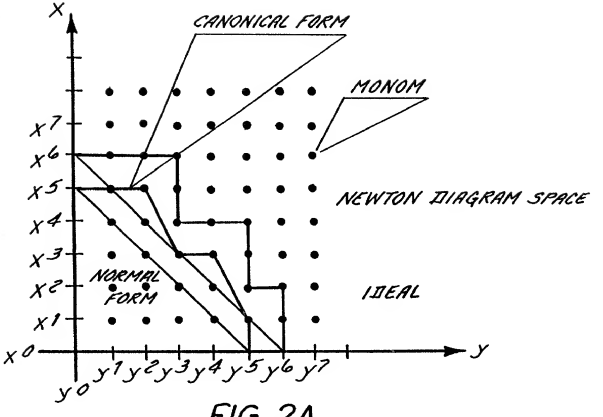

X
CANONICAL FORM
MONOM
NEWTON DIAGRAM SPACE
IDEAL
NORMAL FORM
x7
x6
x5
x4
x3
x2
x1
x0
y
y0 y1 y2 y3 y4 y5 y6 y7

FIG. 2A

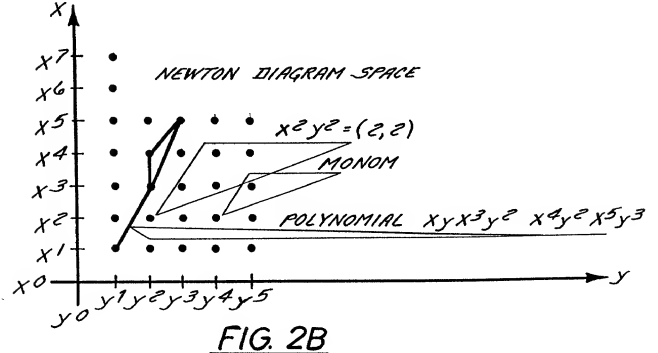

X
NEWTON DIAGRAM SPACE
x2y2=(2,2)
MONOM
POLYNOMIAL xyx3y2 x4y2x5y3
x7
x6
x5
x4
x3
x2
x1
x0
y
y0 y1 y2 y3 y4 y5

FIG. 2B

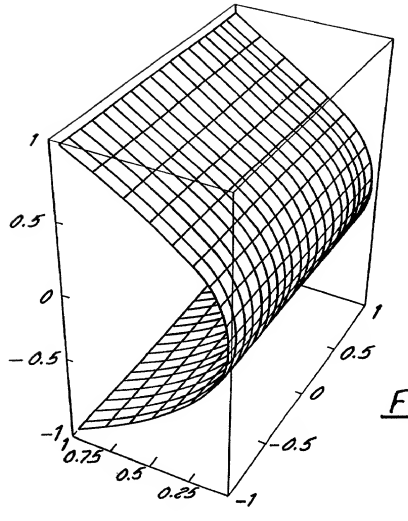


FIG. 3A

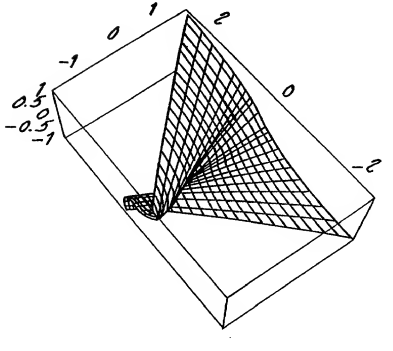


FIG. 3B

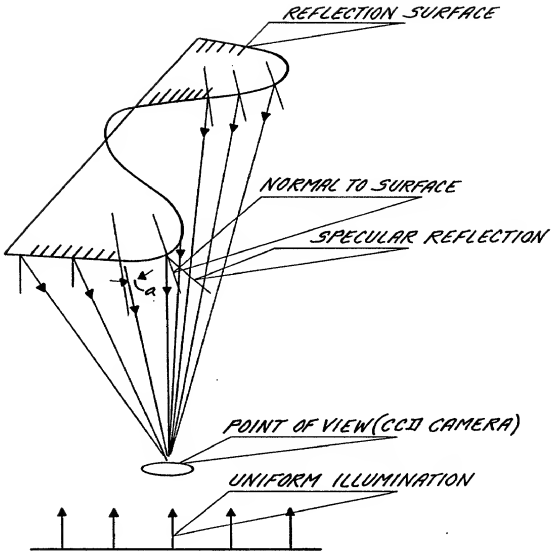


FIG. 4A

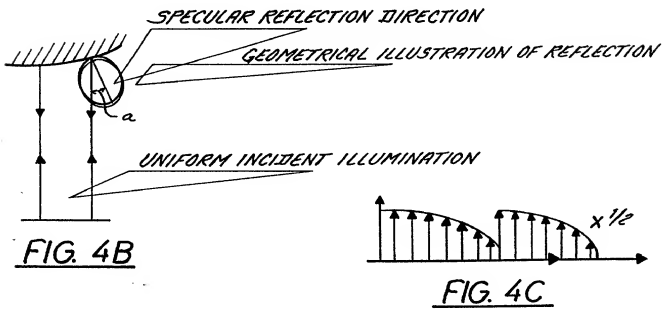


FIG. 4B

FIG. 4C

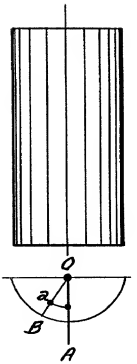


FIG. 5

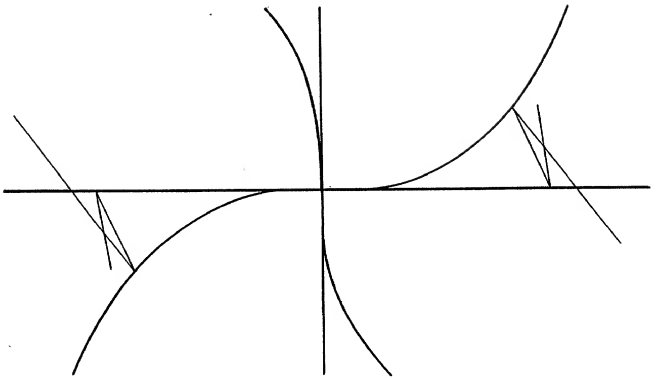


FIG. 6

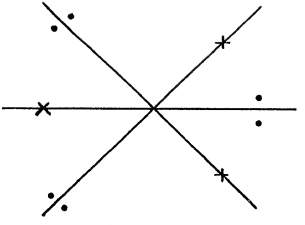


FIG. 7A

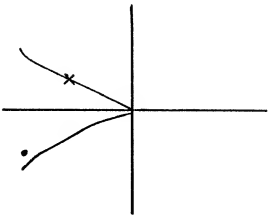


FIG. 7B

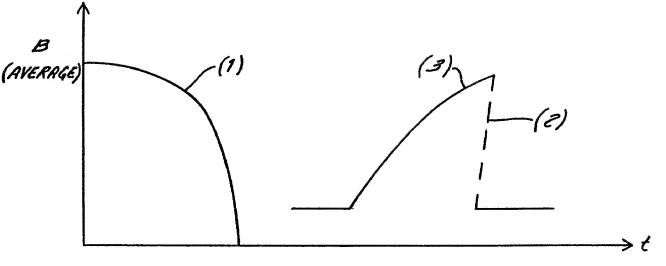


FIG. 8

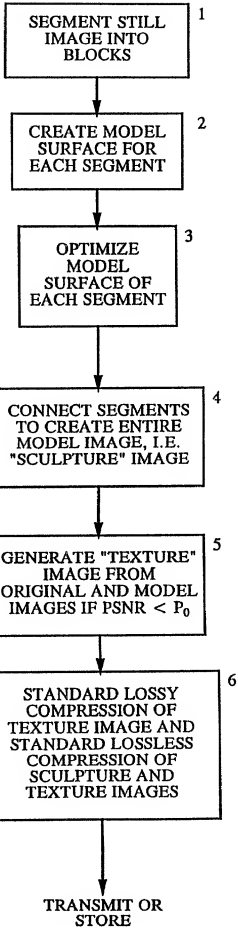

SEGMENT STILL IMAGE INTO BLOCKS
1
CREATE MODEL SURFACE FOR EACH SEGMENT
2
OPTIMIZE MODEL SURFACE OF EACH SEGMENT
3
CONNECT SEGMENTS TO CREATE ENTIRE MODEL IMAGE, I.E. "SCULPTURE" IMAGE
4
GENERATE "TEXTURE" IMAGE FROM ORIGINAL AND MODEL IMAGES IF PSNR < P_0
5
STANDARD LOSSY COMPRESSION OF TEXTURE IMAGE AND STANDARD LOSSLESS COMPRESSION OF SCULPTURE AND TEXTURE IMAGES
6
TRANSMIT OR STORE

FIG. 9

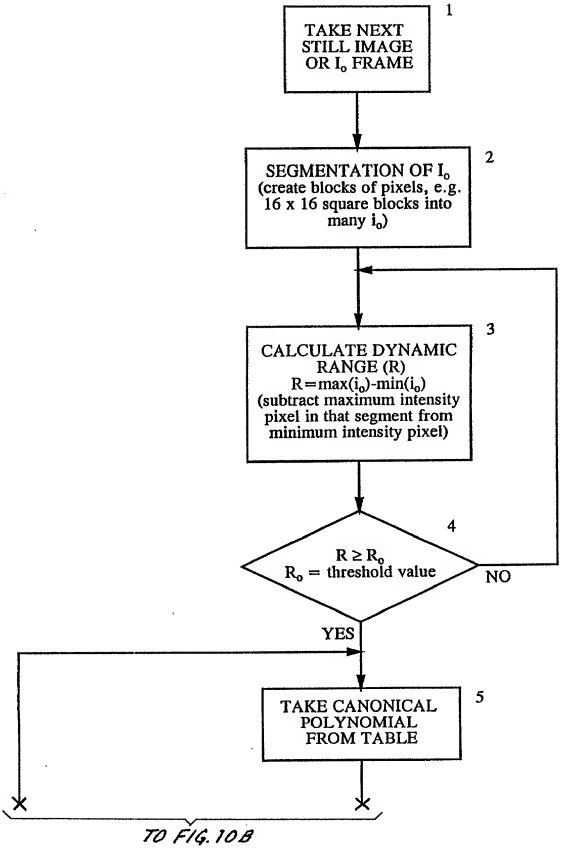

1
TAKE NEXT STILL IMAGE OR I_o FRAME
2
SEGMENTATION OF I_o (create blocks of pixels, e.g. 16 x 16 square blocks into many i_o)
3
CALCULATE DYNAMIC RANGE (R)
$R=\max(i_o)-\min(i_o)$
(subtract maximum intensity pixel in that segment from minimum intensity pixel)
4
$R \geq R_o$
R_o = threshold value
NO
YES
5
TAKE CANONICAL POLYNOMIAL FROM TABLE
TO FIG. 10B

FIG. 10A

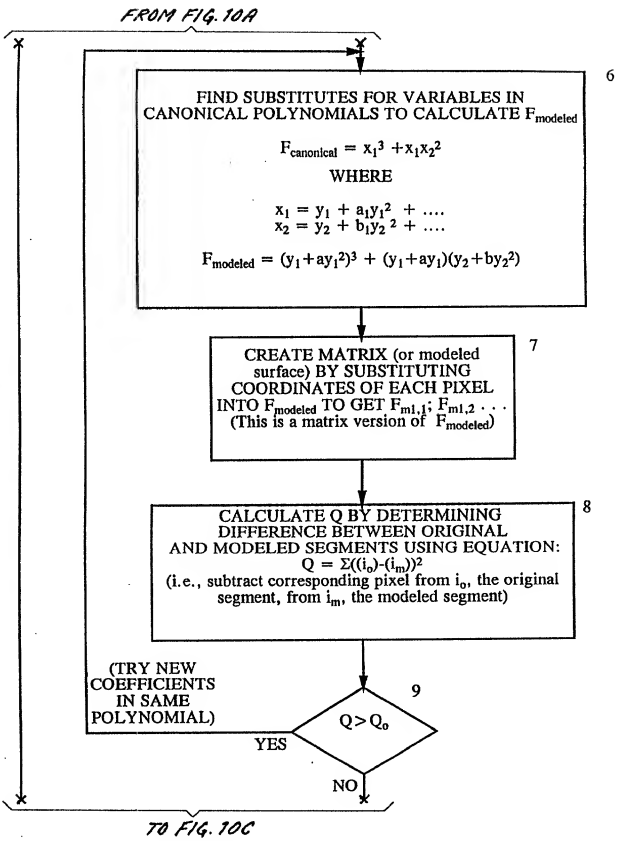

FROM FIG. 10A
6
FIND SUBSTITUTES FOR VARIABLES IN CANONICAL POLYNOMIALS TO CALCULATE $F_{modeled}$
$F_{canonical} = x_1^3 + x_1x_2^2$
WHERE
$x_1 = y_1 + a_1y_1^2 + \ldots.$
$x_2 = y_2 + b_1y_2^2 + \ldots.$
$F_{modeled} = (y_1+ay_1^2)^3 + (y_1+ay_1)(y_2+by_2^2)$
7
CREATE MATRIX (or modeled surface) BY SUBSTITUTING COORDINATES OF EACH PIXEL INTO $F_{modeled}$ TO GET $F_{m1,1}$; $F_{m1,2}$ . . .
(This is a matrix version of $F_{modeled}$)
8
CALCULATE Q BY DETERMINING DIFFERENCE BETWEEN ORIGINAL AND MODELED SEGMENTS USING EQUATION:
$Q = \Sigma((i_o)-(i_m))^2$
(i.e., subtract corresponding pixel from i_o, the original segment, from i_m, the modeled segment)
(TRY NEW COEFFICIENTS IN SAME POLYNOMIAL)
9
$Q > Q_o$
YES
NO
TO FIG. 10C

FIG. 10B

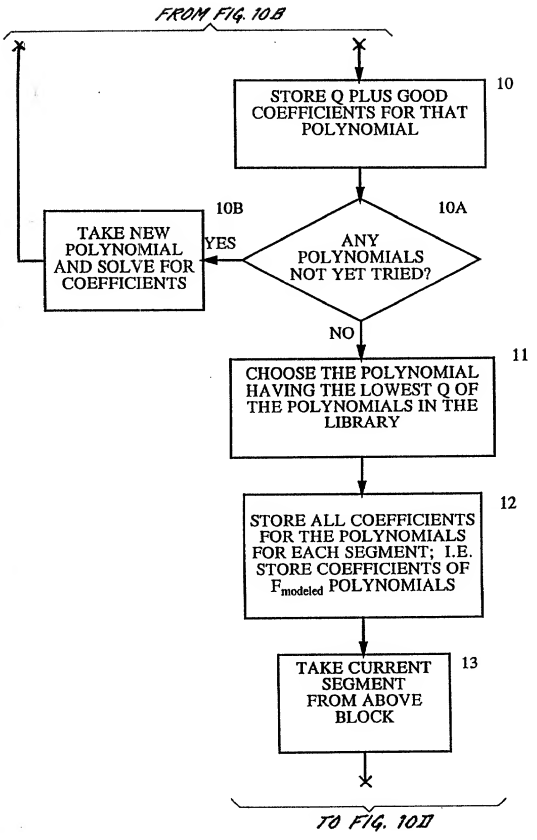

FROM FIG. 10B
STORE Q PLUS GOOD COEFFICIENTS FOR THAT POLYNOMIAL
10
ANY POLYNOMIALS NOT YET TRIED?
10A
YES
10B
TAKE NEW POLYNOMIAL AND SOLVE FOR COEFFICIENTS
NO
CHOOSE THE POLYNOMIAL HAVING THE LOWEST Q OF THE POLYNOMIALS IN THE LIBRARY
11
STORE ALL COEFFICIENTS FOR THE POLYNOMIALS FOR EACH SEGMENT; I.E. STORE COEFFICIENTS OF $F_{modeled}$ POLYNOMIALS
12
TAKE CURRENT SEGMENT FROM ABOVE BLOCK
13
TO FIG. 10D

FIG. 10C

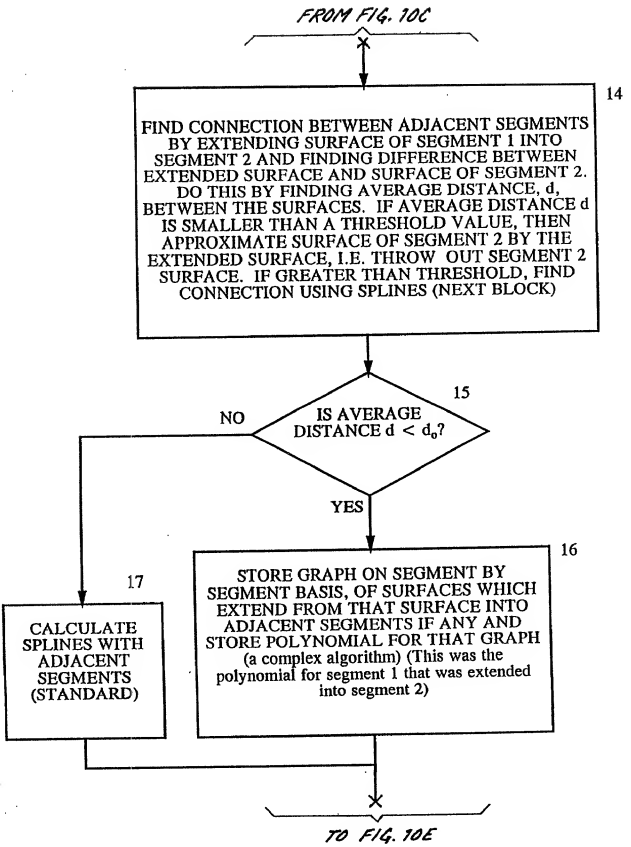

FROM FIG. 10C
14
FIND CONNECTION BETWEEN ADJACENT SEGMENTS BY EXTENDING SURFACE OF SEGMENT 1 INTO SEGMENT 2 AND FINDING DIFFERENCE BETWEEN EXTENDED SURFACE AND SURFACE OF SEGMENT 2. DO THIS BY FINDING AVERAGE DISTANCE, d, BETWEEN THE SURFACES. IF AVERAGE DISTANCE d IS SMALLER THAN A THRESHOLD VALUE, THEN APPROXIMATE SURFACE OF SEGMENT 2 BY THE EXTENDED SURFACE, I.E. THROW OUT SEGMENT 2 SURFACE. IF GREATER THAN THRESHOLD, FIND CONNECTION USING SPLINES (NEXT BLOCK)
15
IS AVERAGE DISTANCE d < d_0?
NO
YES
16
STORE GRAPH ON SEGMENT BY SEGMENT BASIS, OF SURFACES WHICH EXTEND FROM THAT SURFACE INTO ADJACENT SEGMENTS IF ANY AND STORE POLYNOMIAL FOR THAT GRAPH (a complex algorithm) (This was the polynomial for segment 1 that was extended into segment 2)
17
CALCULATE SPLINES WITH ADJACENT SEGMENTS (STANDARD)
TO FIG. 10E

FIG. 10D

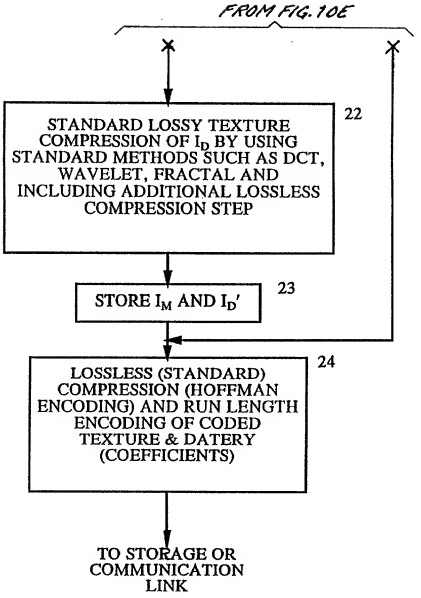

FROM FIG. 10E
STANDARD LOSSY TEXTURE COMPRESSION OF I_D BY USING STANDARD METHODS SUCH AS DCT, WAVELET, FRACTAL AND INCLUDING ADDITIONAL LOSSLESS COMPRESSION STEP
22
STORE I_M AND I_D'
23
LOSSLESS (STANDARD) COMPRESSION (HOFFMAN ENCODING) AND RUN LENGTH ENCODING OF CODED TEXTURE & DATERY (COEFFICIENTS)
24
TO STORAGE OR COMMUNICATION LINK

FIG. 10F

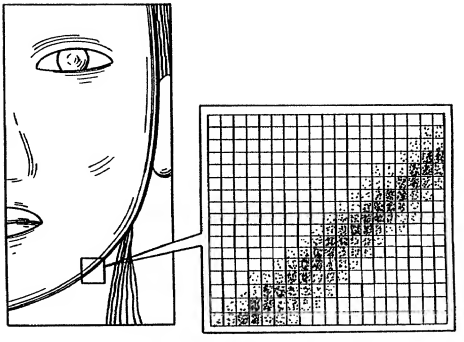
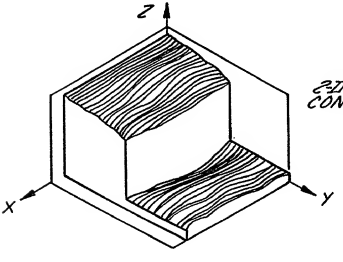
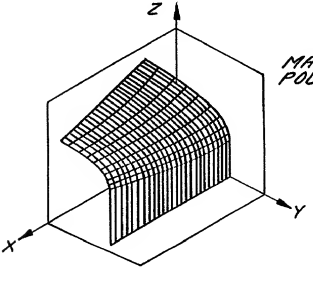


FIG. 11A



2-D CCD
CONTRAST IMAGE

FIG. 11B



MAPPING
POLYNOMIAL SURFACE

FIG. 11C

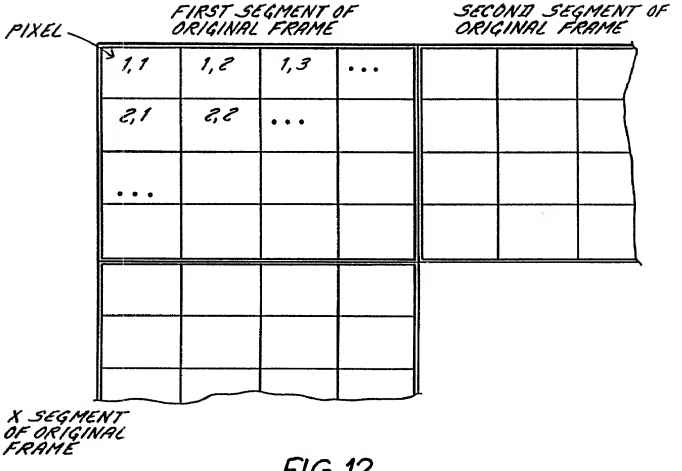

PIXEL
FIRST SEGMENT OF ORIGINAL FRAME
SECOND SEGMENT OF ORIGINAL FRAME
1,1
1,2
1,3
...
2,1
2,2
...
...
X SEGMENT OF ORIGINAL FRAME

FIG. 12

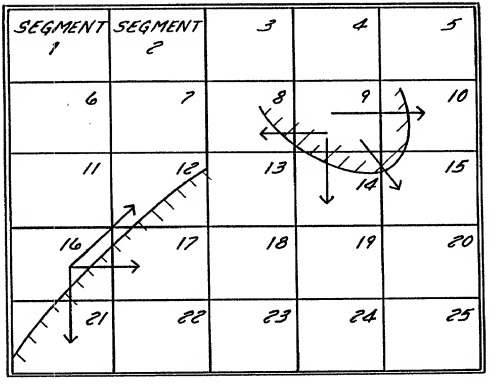
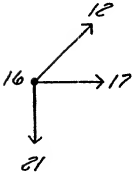
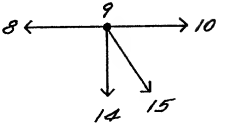


FIG. 13A



GRAPH OF SEGMENT 16'S CONNECTIONS TO ADJACENT SEGMENTS

FIG. 13B



GRAPH OF SEGMENT 9'S CONNECTIONS TO ADJACENT SEGMENTS

FIG. 13C

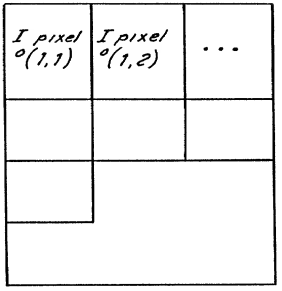


FIG. 14A

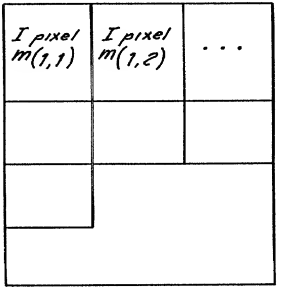


FIG. 14B

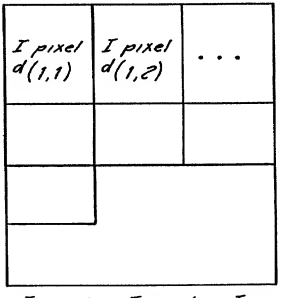


FIG. 14C

$$I_{o(1,1)}^{pixel} - I_{m(1,1)}^{pixel} = I_{d(1,1)}^{pixel}$$

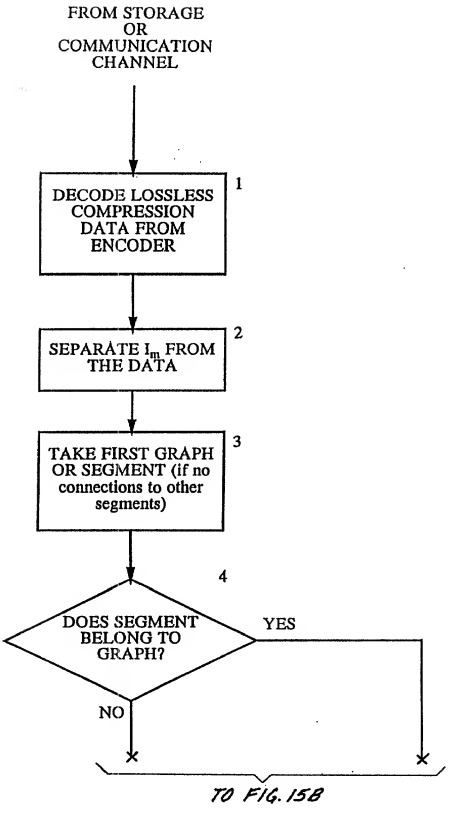

FROM STORAGE OR COMMUNICATION CHANNEL
DECODE LOSSLESS COMPRESSION DATA FROM ENCODER
1
SEPARATE I_m FROM THE DATA
2
TAKE FIRST GRAPH OR SEGMENT (if no connections to other segments)
3
4
DOES SEGMENT BELONG TO GRAPH?
YES
NO
TO FIG. 15B

FIG. 15A

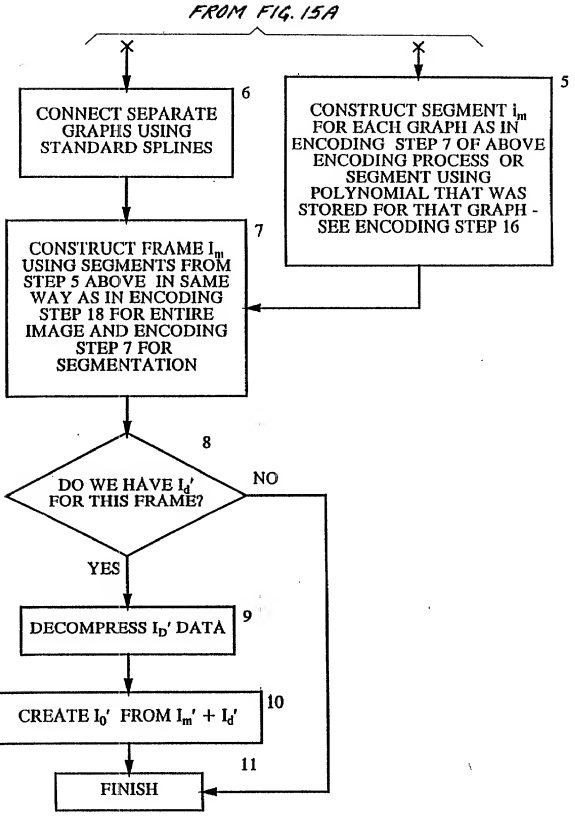
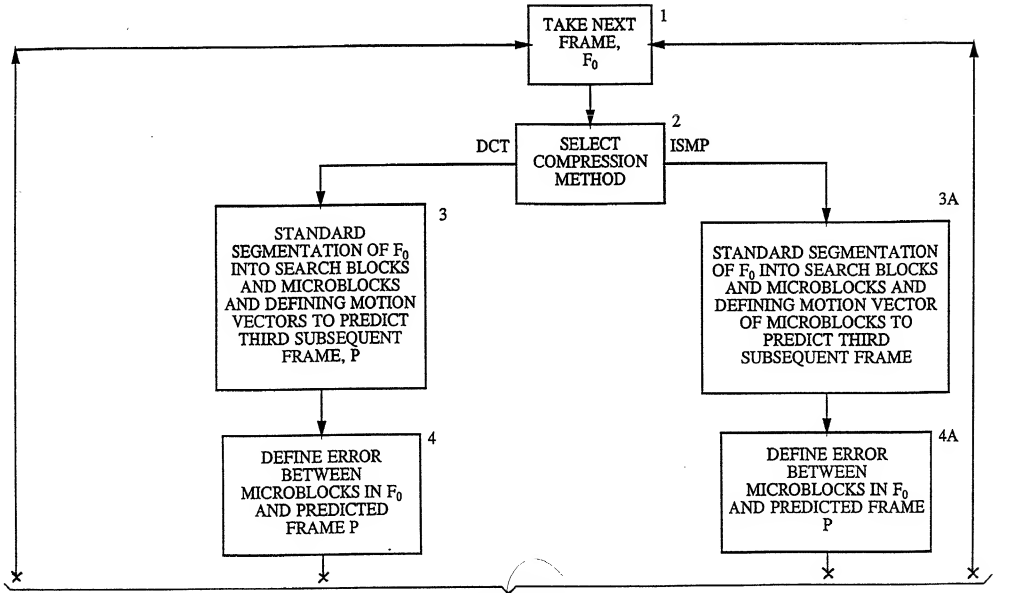

FROM FIG. 15A
CONNECT SEPARATE GRAPHS USING STANDARD SPLINES
6
CONSTRUCT SEGMENT i_m FOR EACH GRAPH AS IN ENCODING STEP 7 OF ABOVE ENCODING PROCESS OR SEGMENT USING POLYNOMIAL THAT WAS STORED FOR THAT GRAPH - SEE ENCODING STEP 16
5
CONSTRUCT FRAME I_m USING SEGMENTS FROM STEP 5 ABOVE IN SAME WAY AS IN ENCODING STEP 18 FOR ENTIRE IMAGE AND ENCODING STEP 7 FOR SEGMENTATION
7
DO WE HAVE I_d' FOR THIS FRAME?
8
NO
YES
DECOMPRESS I_D' DATA
9
CREATE I_0' FROM $I_m' + I_d'$
10
FINISH
11

FIG. 15B



TO FIG. 6B

FIG. 16A

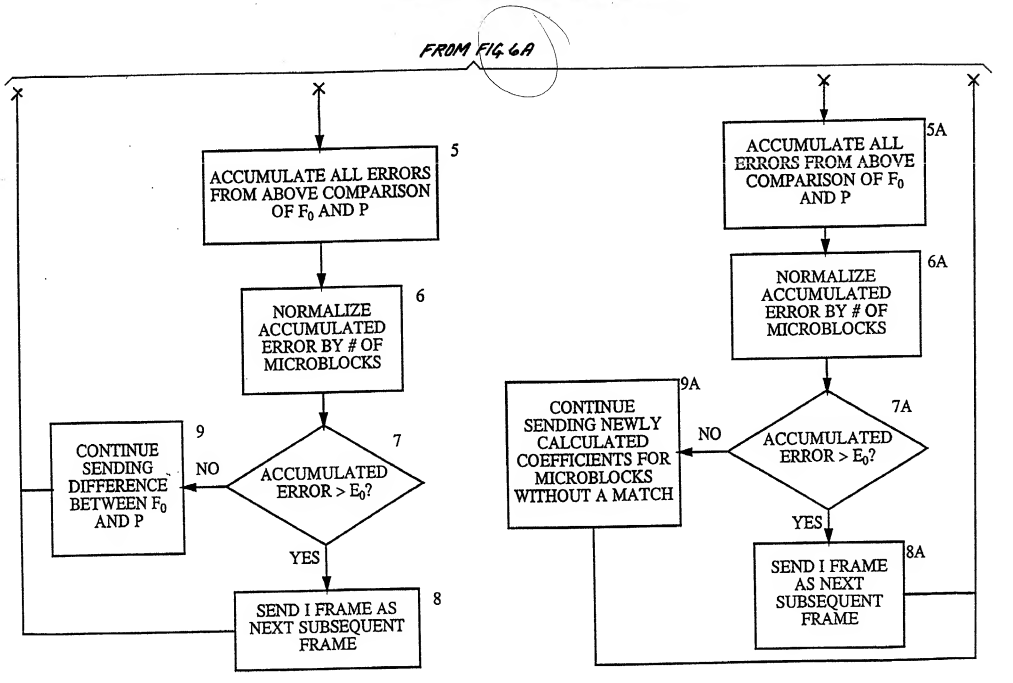

FROM FIG. 6A
ACCUMULATE ALL ERRORS FROM ABOVE COMPARISON OF F_0 AND P
5
NORMALIZE ACCUMULATED ERROR BY # OF MICROBLOCKS
6
ACCUMULATED ERROR > E_0?
7
NO
CONTINUE SENDING DIFFERENCE BETWEEN F_0 AND P
9
YES
SEND I FRAME AS NEXT SUBSEQUENT FRAME
8
ACCUMULATE ALL ERRORS FROM ABOVE COMPARISON OF F_0 AND P
5A
NORMALIZE ACCUMULATED ERROR BY # OF MICROBLOCKS
6A
ACCUMULATED ERROR > E_0?
7A
NO
CONTINUE SENDING NEWLY CALCULATED COEFFICIENTS FOR MICROBLOCKS WITHOUT A MATCH
9A
YES
SEND I FRAME AS NEXT SUBSEQUENT FRAME
8A

FIG.16B

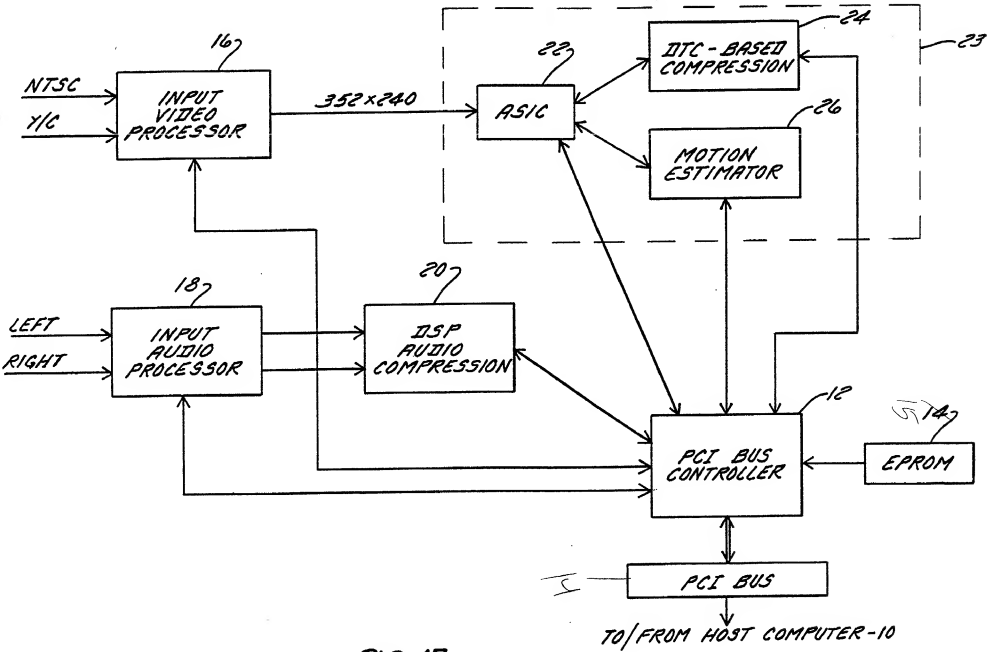

NTSC
Y/C
16
INPUT VIDEO PROCESSOR
352x240
22
ASIC
DTC-BASED COMPRESSION
24
23
MOTION ESTIMATOR
26
LEFT
RIGHT
18
INPUT AUDIO PROCESSOR
20
DSP AUDIO COMPRESSION
12
PCI BUS CONTROLLER
14
EPROM
PCI BUS
TO/FROM HOST COMPUTER-10

FIG. 17

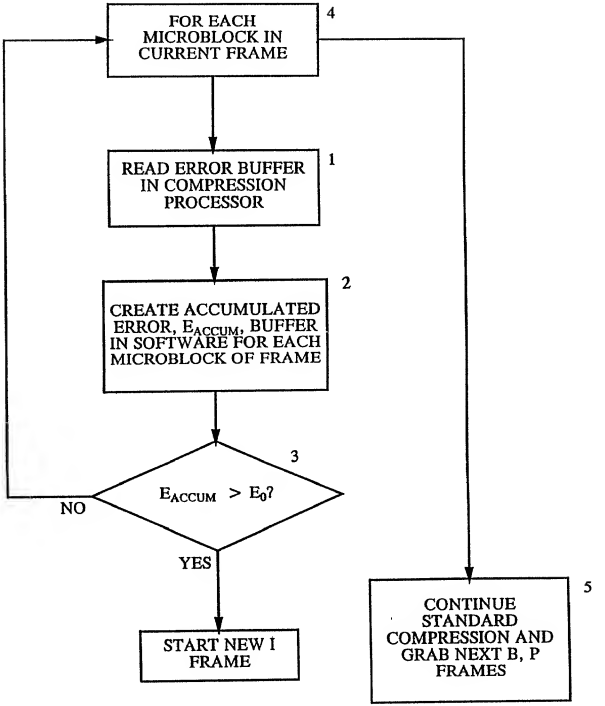

FOR EACH MICROBLOCK IN CURRENT FRAME
4
READ ERROR BUFFER IN COMPRESSION PROCESSOR
1
CREATE ACCUMULATED ERROR, E_{ACCUM}, BUFFER IN SOFTWARE FOR EACH MICROBLOCK OF FRAME
2
$E_{ACCUM} > E_0$?
3
NO
YES
START NEW I FRAME
CONTINUE STANDARD COMPRESSION AND GRAB NEXT B, P FRAMES
5

FIG. 18

#	Category	Data Reduction in Fraction of Original	Reduced Data Rate	Object Category Description
1.	A	100%	128 kbps	Original; possibly with noise.
2.	B	75%	96 kbps	Tiny details of the face (or other biological signature, such as a fingerprint or retina); slightly reduced texture; edges remain unchanged.
3.	C	50%	84 kbps	Hardened edges, wrinkles, smooth transitions for face details.
4.	D	25%	32 kbps	Heavily reduced texture, hard edges.
5.	E	10%	12.8 kbps	Hard edges, "cartoon- type" faces.

FIG. 19